Technology Opportunity
Glenn Research Center • Cleveland • Ohio
Commercial Technology Office
TOP3–00156

New Method for Measuring Contact Angles and Spreading of Liquid Drops

Technology

This process is a new method for measuring contact angles of drops.

Benefits

This technology extends our ability to understand the spreading process of drops by providing information on capillary convection of drops and the effects of evaporation on contact angles over the entire circumference of the drop. These effects are critical to understanding the spreading process but are beyond the range of standard testing procedures. Contact angles anywhere on the circumference can be determined simultaneously. The direct benefits of this technology will be a better understanding of how liquids interact with surfaces leading to improved and cheaper products as well as improved process control.

Commercial Applications

New goniometers (contact angle measuring machines) that can

- Record instant dynamic contact angles of drops over entire circumference of the drops
- Record flow patterns within volatile droplets

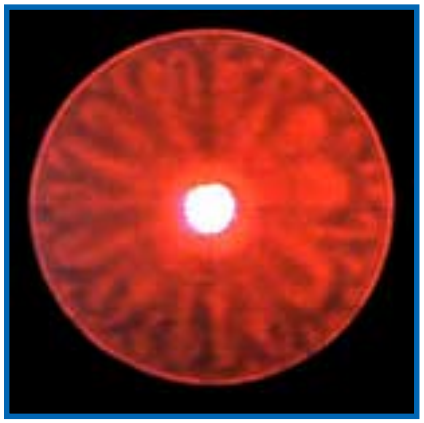
Goniometers are typically employed in the following areas:

- Coatings
- Pharmaceutical industry
- Biomedical research
- Adhesives
- Flat panel display manufacturing
- Surfactant chemistry

Technology Description

The complex physical processes occurring when a liquid contacts a solid play an important role in determining the performance of chemical processes and materials. The new contact angle test covered by this TechOp Sheet permits simultaneous observation of the convective inner flow within a drop and contact angle measurement along the entire periphery of the drop. The interaction of these processes is important in the study of liquid spreading on anisotropic or non-homogeneous surfaces. The apparatus consists of an optical system composed of top-view photography and reflection-refracted shadowgraphy. Together, white light and helium-neon laser light are collimated and passed through a droplet placed on a smooth opaque surface (e.g., aluminized glass). The light beams are reflected by the plate surface and refracted out of the droplet. A beam splitter reorients the reflection-refracted beams horizontally to a vertical screen from which data is recorded. A video recording system synchronously records time-dependent thermocapillary convection and the profile of an experimental droplet on two recorders.

Data have shown that evaporation can play a role in inducing thermocapillary convection, depending on both the liquid and the environmental conditions.



Instant reflection-refracted shadowgraph of freon-113.

Options for Commercialization

This technology opportunity is part of the NASA Technology Transfer Program. The program seeks to stimulate development of commercial applications from NASA-derived technology. A prototype device has been made and tested. Additional development might be needed to optimize and further refine the properties for academic or commercial applications. A patent application is currently being prepared.

If your company is interested in contact angle measuring device technology or if you desire additional information about working with NASA to research surface science problems, please contact the Commercial Technology Office.

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References

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Key Words

Contact angle

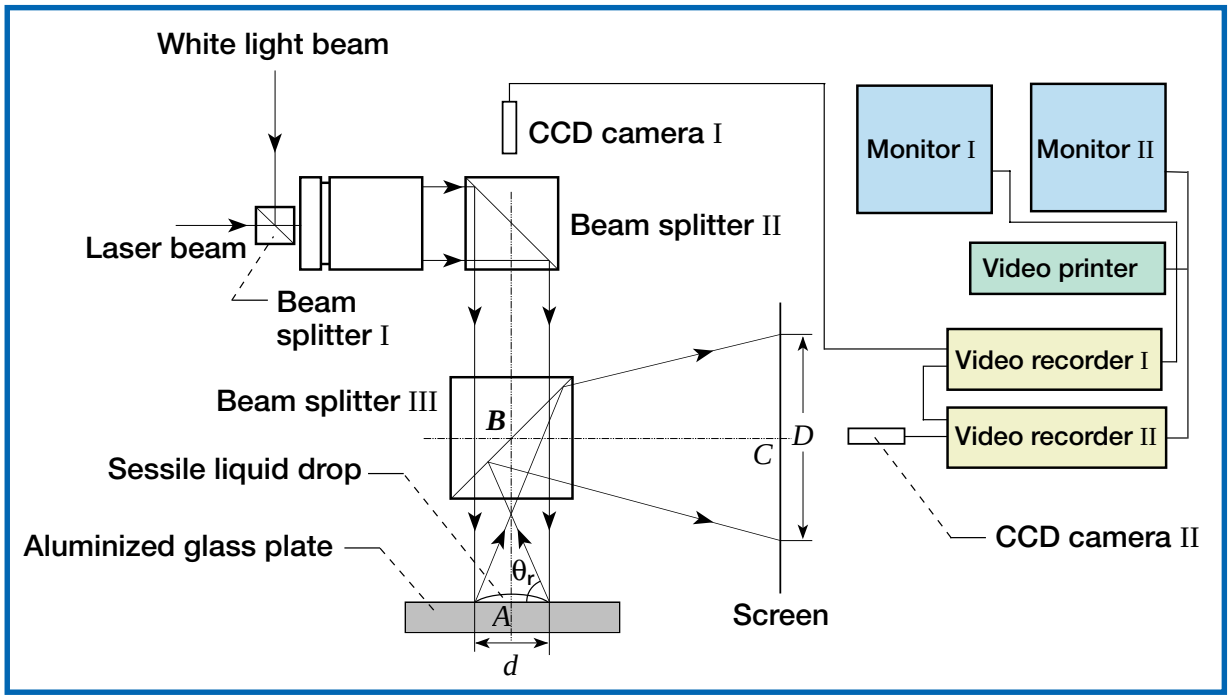
Marangoni-Benard convection

Sessile drops

Surface chemistry

Shadowgraphy

Thermocapillary convective flow



Schematic of a hybrid optical system consisting of laser reflection-refracted shadowgraphy and direct photography.